

WHAT IS CLAIMED IS:

1. A virtual image display apparatus comprising a real image display part for displaying an image, an image magnifying means for optically magnifying the image formed in the real image forming means so as to form a virtual image, and a light guide means for guiding light from the real image display part to the image magnifying means,

    said magnifying means being formed in a triangular columnar shape having a substantially isosceles triangular cross-section, and having a first surface serving a light incident surface, a light emanating surface and a reflective surface, and a first internal reflecting surface and a second internal reflecting surface for reflecting light into the light guide means,

    wherein emanating light from the real image display part is incident upon the light guide means through the first surface, and is then reflected by the first internal reflection surface and the second internal reflection surface, and thereafter, the light emanates from the light guide means entering into the image magnifying means.

2. A virtual image display apparatus comprising a real image display part for displaying an image, an image magnifying means for optically magnifying the image formed in the real image forming means so as to form a virtual image, and a light guide means for

guiding light from the real image display part to the image magnifying means,

the light guide means being formed in a triangular columnar shape having a substantially parallelogram sectional shape and having a first internal reflecting surface and a fourth internal reflecting surface for reflecting light into the light guide means, a second internal reflecting surface serving as a light incident surface and a reflecting surface and a third internal reflecting surface serving as a light emanating surface and a reflecting surface,

wherein emanating light from the real image part is incident upon the light guide means through the second internal reflecting surface, is successively reflected at the first internal reflecting surface, at the second internal reflecting surface, at the third internal reflecting surface and the fourth internal reflecting surface, and thereafter emanates from the third internal reflecting surface and entering into the image magnifying means.

3. A virtual image display apparatus as set forth in claim 1 or 2, wherein an optical distance between the real image display part and the image magnifying means is changed.

4. A virtual image displaying apparatus as set forth in claim 1 or 2, wherein an optical distance between the real image display part and the image magnifying means is changed, and the image magnifying

means can be tilted with respect to the emanating light axis of the light guide means.

5. A virtual image displaying apparatus as set forth in claim 1 or 2, wherein there is provided a light shielding means for covering at least a part of the real image display part.

6. A virtual image displaying apparatus as set forth in claim 1 or 2, wherein there is provided a heat shielding means for covering at least a part of the real image display part.

7. An electronic equipment comprising a transducing means for transducing at least one of a data signal and a voice signal into a transmission signal, or transducing a receiving signal into at least one of a data signal and a voice signal, an antenna for transmitting and receiving the transmission signal and the receiving signal, a speaker for transducing the voice signal transduced by the transducing means into voice, and a microphone for transducing the voice signal into an electric signal, and a virtual image display apparatus as set forth in any one of claims 1 to 6.

8. An electronic equipment as set forth in claim 7, wherein a display means different from the virtual image display apparatus is provided in addition to the virtual image display apparatus.

9. A virtual image display apparatus comprising an image forming means for forming an image, an image

magnifying means for optically magnifying the image formed by the image forming means so as to create a virtual image, and a light guide means for guiding light from the image forming means to the image magnifying means,

wherein a spatial operating distance is less than about 100 mm and an optical path length extending from the light guide means to an eye point is larger than a value which is three times as large as the thickness of the light guide means.

10. A virtual image display means as set forth in claim 9, wherein an optical distance between the image forming means and the image magnifying means is variable.

11. A virtual image display means as set forth in claim 9, wherein there is provided a light shielding means for covering at least a part of the image forming means.

12. A virtual image display means as set forth in claim 9, wherein there is provided a heat shielding means for covering at least a part of the image forming means.

13. An electronic equipment comprising a transducing means for transducing at least one of a data signal and a voice signal into a transmission signal, or transducing a receiving signal into at least one of a data signal and a voice signal, an antenna for transmitting and receiving the transmission signal and

the receiving signal, a speaker for transducing the voice signal transduced by the transducing means into voice, a microphone for transducing the voice signal into an electric signal, a virtual image display apparatus as set forth in any one of claims 9 to 12, and a control means for controlling these parts.

14. A virtual image display apparatus comprising a real image display part for displaying an image, an image magnifying means for optically magnifying the image formed in the real image forming means so as to form a virtual image, and a light guide means for guiding light from the real image display part to the image magnifying means,

    said magnifying means being formed in a triangular columnar shape having a substantially isosceles triangular cross-section, and having a first surface serving as a light incident surface, a light emanating surface and a reflective surface, and a first internal reflecting surface and a second internal reflecting surface for reflecting light into the light guide means,

    wherein emanating light from the real image display part is incident upon the light guide means through the first surface, and is then reflected by the first internal reflection surface and the second internal reflection surface, and thereafter, the light emanating from the light guide means into the image magnifying means,

and wherein a spatial operating distance is less than about 100 mm, and an optical path length extending from the center of the image display part to an eye point is larger than a value which is three times as large as the thickness of the light guide means.

15. A virtual image display apparatus comprising a real image display part for displaying an image, an image magnifying means for optically magnifying the image formed in the real image forming means so as to form a virtual image, and a light guide means for guiding light from the real image display part to the image magnifying means,

the light guide means being formed in a quadratic columnar shape having a substantially parallelogram sectional shape and having a first internal reflecting surface and a fourth internal reflecting surface for reflecting light into the light guide means, a second internal reflecting surface serving as a light incident surface and a reflecting surface and a third internal reflecting surface serving as a light emanating surface and a reflecting surface,

wherein emanating light from the ream image part is incident upon the light guide means through the second internal reflecting surface, is successively reflected at the first internal reflecting surface, at the second internal reflecting surface, at the third internal reflecting surface and the fourth internal

reflecting surface, and is thereafter emanating from the third internal reflecting surface into the image magnifying means, and

wherein a spatial operating distance is less than about 100 mm, and an optical path length extending from the center of the image display part to an eye point is larger than a value which is three times as large as the thickness of the light guide means.

16. A virtual image display apparatus comprising a real image display part for displaying an image, an image magnifying means for optically magnifying the image formed in the real image forming means so as to form a virtual image, and a light guide means for guiding light from the real image display part to the image magnifying means,

said light guide means comprising a first prism, a second prism and an image magnifying means interposed between the first prism and the second prism,

said first prism being formed in a triangular columnar shape having a right triangle section and having a long side used as a first internal surface, a short side used as an emanating surface, and a slope side used as an emanating surface and a second internal reflecting surface,

said second prism being formed in a triangular columnar shape having a long side used as a fourth internal reflecting surface, a short side used as an

incident surface and a slope side used as an incident surface and a third internal reflecting surface,

emanating light from the real image display part is incident upon the incident surface of the first prism, is reflected at the first internal surface and then at the second internal reflecting surface, and emanates from the emanating surface, then is incident upon the second optical prism by way of the image magnifying means, then is reflected at the third reflecting surface and the fourth reflecting surface, and emanates from the emanating surface and enters into the image magnifying means.

17. A virtual image display apparatus as set forth in claim 15 or 16, wherein said fourth internal reflecting surface forms a half mirror, a correction prism formed in a right triangle-like columnar shape is provided outside of the fourth internal reflecting surface, and further, a light shielding mans for controlling light transmitting through the half mirror so as to be transmitted and blocked, is provided to the correction prism.

18. A virtual image display apparatus as set forth in any one of claims 14 to 17, wherein an optical distance between the real image display means and the image magnifying means is variable.

19. A virtual image display apparatus as set forth in any one of claims 14 to 17, wherein an optical distance between the real image display means and the

image magnifying means is variable, and the optical axis of the image magnifying means is tilttable with respect to the emanating optical axis of the light guide means.

20. A virtual image display apparatus as set forth in any one of claims 14 to 17, wherein there is provided a light shielding means for covering at least a part of the real image display part.

21. A virtual image display apparatus as set forth in any one of claims 14 to 17, wherein there is provided a heat shielding means for covering at least a part of the real image display part.

22. A virtual image display apparatus as set forth in claim 24, wherein said first surface is formed as a total reflection surface based upon the Snell's law.

23. A virtual image display apparatus as set forth in claim 15 or 16 wherein the second internal reflecting surface and the third internal reflecting surface are formed as total reflecting surfaces based upon the Snell's law.

24. A virtual image display apparatus as set forth in any one of claims 14 to 23, wherein said magnifying means is an optical member provided adjacent to the emanating surface of the light guide means in a noncontact manner and has a positive refractive power.

25. A virtual image display apparatus as set forth in claim 24, wherein the optical member having a

positive refractive power is a convex lens, an aspherical lens, a Fresnel lens or a hologram lens.

26. A virtual image display apparatus as set forth in claim any one of claims 14 to 25, wherein a space is defined between the real image display part and the light guide means.

27. A virtual image display apparatus as set forth in claim 20, wherein the light shielding means has a light absorbing ability.

28. A virtual image display apparatus as set forth in any one of claims 14 to 21, wherein a light shielding means is provided a part of the surface of the light guide means.

29. A virtual image display apparatus as set forth in claim any one of claims 14 to 21, wherein there is provided a support member for supporting the light guide means, and the support member has a light absorbing ability.

30. A virtual image display apparatus as set forth in claim 21, wherein a space is defined between the heat shielding means and the light guide means.

31. A virtual image display apparatus as set forth in claim 21 or 31, wherein the heat shielding means has a light absorbing ability.

32. An electronic equipment comprising a transducing means for transducing at least one of a data signal and a voice signal into a transmission signal, or transducing a receiving signal into at least

one of a data signal and a voice signal, an antenna for transmitting and receiving the transmission signal and the receiving signal, a speaker for transducing the voice signal transduced by the transducing means into voice, and a microphone for transducing the voice signal into an electric signal, a virtual image display apparatus as set forth in any one of claims 14 to 31, and a control means for controlling the several parts.

33. An electronic equipment as set forth in claim 32, wherein a display means different from the virtual image display apparatus is provided in addition to the virtual image display apparatus.

34. An electronic equipment as set forth in claim 32, wherein a display window is formed in a housing of the electronic equipment so as to display a virtual image formed by the virtual image display apparatus, through the intermediary of the display window.

35. An electronic equipment as set forth in any one of claims 32 to 34, wherein the longitudinal direction of the electronic equipment is parallel with that of the virtual image display apparatus.

36. An electronic equipment as set forth in any one of claims 32 to 35, wherein the heat shielding means stated in claim 21 is spaced from the housing.

37. An electronic equipment as set forth in any one of claims 32 to 35, wherein a slit is formed in a surface of the housing, which is different from the surface where the display window is formed.